THE BACTERIA IN NORMAL AND DISEASED LUNGS OF SWINE

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Investigations of diseases of swine, for the past few years, have centered about 3 diseases prevalent among pigs, namely, hog cholera, infectious abortion, and infectious pneumonia. During the years 1917 and 1918 infectious pneumonia, commonly called "hemorrhagic septicemia" or "flu," increased alarmingly, and was by many thought to be associated with the human influenza epidemic of the same period. This paper deals only with the subject of pneumonia.

In reviewing the subject of pneumonia of swine it is necessary to refer briefly to the early work on a number of very similar, or similarly named, diseases, some of swine, such as hog cholera, swine plague, swine erysipelas, schweineseuche, pneumo-enterite, rouget du porc, and svin pest, as well as those of other animal species, such as fowl cholera, rabbit septicemia, rinderseuche, wildseuche, büffelseuche, and others. These diseases were recognized early as septicemias, and were collectively termed "septikämia hämorrhagica" by Hueppe.[1]

The pathology as described varies widely in the different animal species, but commonly takes the terminal form of an acute respiratory infection producing pulmonary complications leading to bronchial or lobar pneumonia, hence the terms infectious pneumonia, or pneumo-enterite. In the final stages there is usually an intense septicemia, probably most conspicuous in fowl cholera and in virulent cases of swine plague, hence fowl, swine, rabbit, and cattle septicemia.

The disease was apparently recognized before the era of bacteriology by Sutton (1850), Snow (1861), Law (1875), and others. In 1876 Detmers observed an organism in the blood of swine dying of "hog cholera." This observation was later confirmed by Billings, Löffler,[2] and Schütz,[3] and the organism is commonly called the "Löffler-Schütz Bacillus."

Preceding these observations Davaine[4] had demonstrated a similar organism in the blood of rabbits injected with putrid ox blood. Coze and Feltz[5] obtained similar results with putrid organic matter, and Sternberg, in 1887, isolated a like organism from the liver of a yellow-fever cadaver. Gaffky[6] reported the

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[1] Berl. klin. Wchnschr., 1886, 44, p. 753; 45, p. 776; 46, p. 794.

[2] Arbeit. a. d. kais. Gesundheitsamte, 1886, 1, pp. 46 and 546; Mitteil. a. d. kais. Gesundheitsamte, 1884, 2, p. 421.

[3] Arbeit. a. d. kais. Gesundheitsamte, 1885, 1, pp. 56 and 376; Arch. f. wiss. u. prakt. Thierheilk., 1886, 12, p. 210; 1888, 14, p. 223.

[4] Compt. rend. de l'Acad. d. sc., 1869, 68, p. 163; Bull. de l'Acad. de méd., 1872, 1, pp. 907, 976, 1004, 1100, 1234.

[5] Recherches Experimentales sur la Presence des Infusiores et l'Etat du Sang dans les Maladies infectieuses, 1869.

[6] Mitteil a. d. kias. Gesundheitsamte, 1881, 1, p. 50.

isolation of the same organism from river water, and Baumgarten[7] states that it may be found occasionally in human saliva. Perroncito,[8] Semmer,[9] Pasteur,[10] Kitt,[11] and others reported the same results in studying diseases of horses, sheep, cattle, swine, and fowls.

Löffler,[2] Schütz,[3] and Hueppe,[1] reviewing previous work, were convinced of the similarity or identity of these septicemias, and established the nature of the infection and the biologic and pathologic properties of the organisms in question. Lignières[12] studied intensively the inter-relationships of the organisms from the various animal species, and placed them in a group under the name "Pasteurella," previously proposed by Trevisan.

In the review of all of this work it may be noted that the pneumonias of the various animals are almost uniformly ascribed to pasteurella infections, the presence of other organisms being usually entirely disregarded. The same is equally true of the recent work. The possibility of the importance of other organisms in similar infections appears to have been overwhelmed by the weight of the early authorities. Birch and Benner[13] recently recorded an outbreak of pneumonia in swine apparently due to infection with Ps. pyocyaneus. Murray[14] has also recently described an epidemic, with a low mortality, among swine in which a small gram-negative micrococcus was constantly found. A few authors consider the possible predisposing, or secondary, rôle of other organisms.[15] Aside from these few citations, and excepting "distemper" of horses and dogs, the literature on pneumonias among animals, and swine in particular, is concerned only with organisms of the pasteurella group.

The work now reported was undertaken with the object of ascertaining whether the highly infectious pneumonias so common in swine are associated solely with an infection with B. suisepticus, as seems to be commonly accepted in the early, as well as the recent literature. In a previous study it was found that the bacterial flora of diseased lungs was inconstant and decidedly variable, and that B. suisepticus was not present in sufficient numbers, nor in such percentage of cases as to warrant the sweeping conclusion that B. suisepticus was entirely responsible for the respiratory and intestinal lesions so common in 1918.

Arrangements were made for access to the killing floor in the pork department of one of the large Chicago packing houses. The viscera of the slaughtered pigs were observed on the moving inspecting table as they passed the Federal inspectors. The lungs were selected and tied off with a cord, severed from the other organs, and carried to one side for study and culture.

[7] Lehrbuch der Path. Mykologie, 1888-90, 2, p. 489.
[8] Recueil de Med. vet., 1880, 7, p. 523; Arch. f. wiss. u. prakt. Thierheilk., 1879, 5, p. 22.
[9] Deutsch. Ztschr. f. Thiermed. u. Vergl. Path., 1878, 4, p. 244; Virchows Archiv., 1880, 82, p. 549.
[10] Compt. rend. de l'Acad. des sc., 1880, 90, pp. 239, 952, 1030.
[11] Sitzungsber. der Gesellsch. f. Morph. u. Path. in München, 1885, 1, p. 140.
[12] Bull. de la Soc. entr. de Med. vet., 1898, 761, 797, 836; 1900, 329, 389, 469, 529.
[13] Cornell Vet. Review, 1920, p. 176.
[14] Am. Vet. Med. Assn. Jour., 1920, 57, p. 539.
[15] Dimock: Ibid., 1919, 54, p. 330. Jorgenson: Ibid., p. 738. Stange: Ibid., p. 740. Salmon: Rept. Comm. of Agric., 1886, and 1888.

In order to have a basis for comparison of the bacteria of normal and diseased lungs it was decided to study the bronchial flora of 100 apparently normal lungs. For this purpose only those lungs were selected which were of a healthy pink color and which were entirely free from any visible exterior lesions. After swabs and washings had been taken the lungs were dissected and the bronchi searched for internal lesions. Occasionally lungs which were normal from the surface appearance were found to be grossly hemorrhagic on sectioning, or showed lesions along the mucous surface of the bronchi. Such lungs and the corresponding cultures were not included in the "normal" series.

Having determined, by the study of these 100 normal lungs, the presence of a "normal" flora, the study of pneumonic lungs was carried out on 314 lungs showing various degrees of congestion, consolidation, or adhesions.

Technic.—The upper lobe of the normal lungs was selected as the point most remote from possible contamination, and inoculations were made from this region when possible. Such selection was naturally impossible in many cases of pneumonia.

The lung surface was swabbed with 10% phenol, then cut transversely midway between the tip of the lobe and the junction of the bronchi and trachea. The cutting was continued until the bronchus was exposed. The surface of the bronchus was further exposed by scraping, after which it was swabbed with phenol and then severed with a sterile scalpel. Sterile swabs were then introduced, then the bronchial secretions were washed loose and pipetted out in sterile saline for plate inoculations.

The swabs were taken at once to the laboratory where they were stroked on plain and blood-agar plates, and the washings also plated on Endo medium as a control of contamination. Selected colonies were replated and pure cultures isolated for identification on plain or blood-agar slants.

Owing to the proposed extent of the study examination was restricted to those organisms which were constantly present in significant numbers. Since this study was devoted to pneumonia the pneumococcus-streptococcus and the pasteurella groups were regarded as probably of greatest importance, while earlier experience pointed to the B. suipestifer group as of possible significance.

Sections of the pneumonic lungs enclosing the consolidated portions were cut out and wrapped in sterile paper and carried to the laboratory.

Here the lung surface was carefully seared, cut, and cultures taken from the bronchi. It was decided in the work on normal lungs that the use of plain agar added nothing of importance to the findings, and after the first 30 examinations only blood-agar and Endo medium were used.

Material was cut and fixed for future sectioning in 10% formalin. The tissues were imbedded in paraffin, and the pathologic study and correlation with the bacteriologic findings will form the basis of a later paper.

Bacteriology of Normal Lungs.—In the tables the term "pure culture," as used, includes not only strictly pure cultures, but also those which were pure with the exception of an occasional obvious contaminating colony. The term "many colonies" refers to the presence of the organism in predominance and in numbers sufficient to warrant attributing some significance to its presence. The term "few colonies" was applied to the occasional finding of from a single colony up to 10 or 20, a condition differing sharply from those cultures yielding "many colonies." Just what degree of importance is to be attributed to the presence of these organisms in small numbers may be shown by the pathologic study, when it will be possible to compare the bacterial findings with the type and stage of the particular pneumonia in question.

Only 3 groups of organisms were isolated in pure culture with any degree of frequency in this study. The incidence of these pure cultures is recorded in table 1.

TABLE 1

COMPARISON OF BACTERIA FOUND IN PURE CULTURE IN APPARENTLY NORMAL AND PNEUMONIC LUNGS

	Normal Lungs (100 Specimens)		Pneumonic Lungs (314 Specimens)	
	Number of Specimens Yielding Culture	Percentage of Specimens Yielding Culture	Number of Specimens Yielding Culture	Percentage of Specimens Yielding Culture
B. suisepticus, pure culture.....	2	2	138	44
Inulin-fermenting streptococcus, pure culture.....	0	0	91	29
B. alkaligenes type, pure culture....	1	1	1	0.3

Examination of table 1 shows that only 2 of the 100 apparently normal lungs yielded pure cultures of B. suisepticus. A single pure culture of a B. alkaligenes type was found. The inulin-fermenting streptococcus was not found in pure culture in any normal lung. In addition to the pure cultures isolated, the 3 significant organisms were

frequently found in mixed culture. The total incidence of these 3 types, including both pure and mixed culture, is recorded in table 2.

In addition to those organisms present in considerable numbers, various streptococci were commonly found in smaller numbers, together

TABLE 2

COMPARATIVE INCIDENCE OF THE SIGNIFICANT ORGANISMS FOUND IN APPARENTLY NORMAL AND PNUEMONIC LUNGS

Organisms	Relative Frequency on Original Plating	Normal Lungs (100 Specimens)		Pneumonic Lungs (314 Specimens)	
		Number of Specimens Yielding Culture	Percentage of Specimens Yielding Culture	Number of Specimens Yielding Culture	Percentage of Specimens Yielding Culture
B. suisepticus	Many colonies	2	2	123	40
	Few colonies	2	2	45	14
			— 4		— 54
Inulin-fermenting streptococcus	Many colonies	5	5	93	29
	Few colonies	7	7	18	6
			— 12		— 35
B. alkaligenes type	Many colonies	1	1	6	2
	Few colonies	2	2	4	1
			— 3		— 3

TABLE 3

COMPARATIVE INCIDENCE OF STREPTOCOCCI IN APPARENTLY NORMAL AND PNEUMONIC LUNGS

	Normal Lungs			Pneumonic Lungs		
	Number of Cultures Isolated	Number of Specimens Yielding Cultures	Percentage of Specimens Yielding Cultures	Number of Cultures Isolated	Number of Specimens Yielding Cultures	Percentage of Specimens Yielding Cultures
Streptococci present, usually but 3-5 colonies	..	89	89	..	183	60
S. pyogenes	1	1	1	..	...	..
S. fecalis	19*	13*	13	11	9	9
S. mitis (type)	23	17	17	14	12	4
S. mitis (var. inulin +)	14	12	12	114	111	34
S. salivarius	8	6	6	13	10	3
S. non-hemolyticus ii	12	8	8	11	8	3
S. non-hemolyticus iii	4	3	3	..	..	..
S. equinus	33	22	22	27	21	7
S. ignavus	9	6	6	8	7	2

* In many instances 2 or 3 apparently different colonies from the same specimen proved culturally identical.

with other organisms. An attempt was made to isolate one of each type of streptococcus colony found on the original blood-agar plates. These cultures were then subjected to the Holman system of classification with the results shown in table 3.

The figures in table 3 indicate the relative incidence of the various types rather than the specific incidence. The important point brought out in the table is the isolation of an inulin-fermenting streptococcus from 12% of the apparently normal lungs examined. The characteristics and possible significance of its presence will be discussed later.

Cultural Characteristics.—The biologic and morphologic characteristics of B. suisepticus are too well known to require further description. The point of significance, as indicated in this study, is the isolation of the organism from only 4% of the apparently normal lungs. It is commonly stated that B. suisepticus, in an avirulent form, is widely distributed in the lungs of normal swine, and that such animals serve as foci of infection under proper conditions. Such a condition is certainly not indicated by the results of these observations. In two cases B. suisepticus was recovered in pure culture in large numbers, and, while the lungs were apparently normal, the possibility of an impending pneumonia cannot be overlooked. In only two other cases was the organism found in small numbers, under conditions which might warrant the assumption of the status of a normal carrier.

Two organisms other than B. suisepticus were isolated early in the study of normal lungs. One of these grew on Endo medium, producing typical paratyphoid colonies, but failed to ferment any of the sugars tested, and was regarded as a B. alkaligenes type. The other was a diplococcus, or short-chain streptococcus, which developed more or less pneumococcus-like colonies on blood-agar; produced a distinct green halo without complete hemolysis; coagulated milk; fermented inulin; did not have a demonstrable capsule; was not soluble in bile; and was not agglutinated by pneumococcus type 1, 2 or 3 antiserum. Neither of these two organisms were frequent in the normal lungs, but they were conspicuous by their peculiar reactions.

In addition to these organisms several other common types were rather constant, although present only in too small numbers to be of significance, and never in pure culture. Staphylococcus albus was isolated from 49 lungs, there being in most cases only 2 to 4 colonies on the original plates. In two instances there were from 25 to 30 colonies, together with a variety of other organisms. Staphylococcus aureus was found in 15 cases, but never more than 4 or 5 colonies from one specimen. A large whitish colony, which produced a broad hemolytic zone, was observed in 12 instances. The organism was a tiny gram-positive, sporing bacillus. Never more than 1 or 2 colonies were found

on any one plate, and this organism was regarded as a chance contamination, probably of mouth origin. A gram-negative diplococcus which produced waxy-mucoid colonies and closely resembled Micrococcus pharyngis siccus, was found in 12 cases, but never in significant numbers. One other type of colony was frequently encountered—in 38 instances. This was a large spreading, green colony, surrounded by a broad, diffuse zone of incomplete hemolysis. This organism also was a small, gram-positive, sporing bacillus, which produced a strong odor of ammonia on blood-agar plates. There were usually only 1 or 2 colonies, rarely 3 or 4, on any one plate, and it also was regarded as a contaminating organism, probably of mouth or fecal origin. This list comprises all organisms found in any degree of frequency under the conditions of this study.

Five specimens did not yield any growth on either blood agar or Endo medium.

Pathogenicity of Bacteria from Apparently Normal Lungs.—Saline washings from the bronchi of normal lungs were injected intraperitoneally into 18 white mice. One c c of a turbid emulsion of mucus and the contained bacteria was injected into each mouse. None of the mice died, and only 3 showed any visible reaction, but these were normal on the third day after inoculation when they were killed. Stained smears from the peritoneal cavities did not reveal any bacteria. It was evident that there were no organisms in these specimens with any degree of pathogenicity for white mice.

Six strains of B. suisepticus-like organisms were tested for virulence on rabbits by injecting subcutaneously 0.5 c c of a saline suspension of a 24-hour blood-agar culture. Two strains produced no evident reaction, and further study of the fermentative ability showed that, while similar, they were entirely distinct from B. suisepticus. Two typical strains of B. suisepticus were observed in large numbers in pure culture on the original plates, while 2 other strains were present only in small numbers. The 4 rabbits inoculated with these strains all died within 3 days, and the typical bipolar organisms were found in abundance in the heart blood of all.

One strain of the B. alkaligenes type was inoculated into a rabbit with no visible reaction.

The pathogenicity of the inulin-fermenting streptococcus from normal lungs was not tested, but will be discussed later in connection with the study of the pneumonic lungs.

Bacteriology of Pneumonic Lungs.—In view of the results obtained from the apparently normal lungs attention was focused on the three bacterial types emphasized in the foregoing. The secondary organisms listed appeared in approximately the same numbers in the plates from the pneumonic lungs, but in considering such a large number of specimens it was found impossible to study these organisms intensively. The streptococcus group, however, was studied for comparison with the incidence of the inulin-fermenting type. According to the Holman classification they were grouped as noted in table 3.

In comparing the streptococci from the normal and pneumonic lungs it would appear, at first sight, that there are relatively fewer streptococci, other than the inulin-fermenting type, to be found in the pneumonic lungs. These results are undoubtedly due to the preponderance of the inulin-fermenting type, leading to the overlooking of the other types which were always few in number. A careful study of this particular point would probably show an approximately equal incidence of the streptococci, excepting the inulin-fermenting strain, in both normal and pneumonic lungs.

Two striking facts may be observed by comparison of the bacteria found in normal and pneumonic lungs, as shown in table 1: First, pure cultures of B. suisepticus were found in 44% of pneumonic lungs, but in only 2% of normal lungs. Second, pure cultures of the inulin-fermenting streptococcus were found in 29% of the 314 pneumonic lungs, but in none of the normal lungs.

It is evident, from perusal of the tables, that there are only two groups of organisms which are consistently present in numbers sufficient to warrant closer study:

B. suisepticus was recovered from 4% of the 100 normal lungs examined. Of these 4% only 2% were present in pure culture.

B. suisepticus was recovered from 54% of all pneumonic lungs examined. Of these, 54% pure cultures were found in 44%, while in 10% more it was present in mixed culture and in variable numbers.

The inulin-fermenting streptococcus was isolated from 12% of the normal lungs. It was not found in pure culture in any of the normal lungs.

The inulin-fermenting streptococcus was isolated from 35% of the 314 pneumonic lungs examined. In 29% of the cases it was present in pure culture, while in 6% more it was observed in varying numbers together with other organisms.

In 58 cases, or 15% of the pneumonic lungs, the two types of organisms occurred together in large and approximately equal numbers. The pathology of such cases will constitute a topic for special study later.

Description of the Inulin-Fermenting Streptococcus.—In classifying this organism according to the Holman system it falls within Streptococcus mitis group. Because of the ability to ferment inulin it would be classed as a variety within the "mitis" group. The occurrence of such a variety has been noted, and Holman [16] says: "I believe that the inulin variety of streptococcus exists, and that it may be more common than I have indicated."

The organism is typically a diplococcus when stained in bronchial mucus smears; ovoid to almost lanceolate at times; never in long chains in the bronchial secretions, although at times in short chains of 6 to 8 cells, but always distinctly in pairs in such cases; commonly found in clumps of typical gram-positive diplococci; capsules, or even doubtful indications of such, have never been demonstrated.

The first generations on blood-agar are commonly very pleomorphic; some strains maintain this character indefinitely, while others seem to revert quickly to the typical morphology. Such pleomorphic strains show bacillary forms of all conceivable types, together with typical diplococci and chains of pairs of varying length. These strains also display a great deal of gram-negative material, both as organized cells and as cells in all stages of decomposition.

Serum broth and milk appear to offer more favorable conditions for growth of the earlier generations, the cultures in these mediums usually displaying less pleomorphism, and conforming more to the original type, except in the tendency toward chain formation, which is more pronounced here than in cultures on blood agar. These chains uniformly show a distinct arrangement of the cells in pairs.

Cultural Characteristics.—The reaction on blood agar is quite constant for the entire group of 128 strains from both normal and pneumonic lungs. The colonies at 24 hours are about 0.5 mm. in diameter, on the average, tending to remain discrete, round, entire edged, slightly raised center, yet no tendency to form the typical nippled streptococcus colony except on prolonged incubation on dried plates, when a slight nipple formation may appear. Old colonies reach a maximum size of about 2 mm.

[16] Jour Med. Research, 1916, 34, p. 388.

The colonies are uniformly surrounded by a distinct zone of green. True hemolysis does not develop even after prolonged incubation. Thirty strains were plated at one time on blood agar in order to compare the colony characteristics; while there appeared some slight individual variations there was a great similarity, approaching identity, of all strains.

The reaction in milk was identical for all strains. An acid reaction was apparent at 24 hours, together with decolorization of the litmus indicator in the lower half of the tube; coagulation appeared quite constantly at 48 hours, with a few strains showing a tendency to coagulate at 24 hours.

These tests were run in serum-sugar broth with the Andrade indicator. Pig serum water (1 part serum to 3 parts distilled water) was added to veal infusion broth (1 part serum water to 4 parts broth; final reaction 7.6 to 7.8). The mannite and lactose broth contained 1% of the sugar, while the inulin and salicin broths were made up to only 0.1%. A few early tests were run in 1% salicin and inulin, but some of the results with salicin suggested a possible inhibition, and the use of the smaller amount was adopted.

The reactions in the 4 sugar broths were very constant. The characteristic reaction was acid and there was coagulation at 24 hours in the lactose, salicin, and inulin serum broth, with no perceptible change in the mannite broth. Some of the freshly isolated strains gave doubtful, and occasionally negative, reactions in one or more of the sugars. Repetition of the test resulted, in almost every case, in a typical completely positive reaction, while in other cases the acid reaction was evident but did not progress to the point of coagulation. Correlation of these atypical fermentative results with poor growth or pleomorphism was in most instances demonstrable by staining.

Nine strains from normal lungs and 102 strains from pneumonic lungs were tested for solubility in bile. None of the strains showed the slightest trace of solubility, while control tests with Pneumococcus type 1, 2 and 3 were always completely positive.

Serologic Study.—Agglutinative typing was begun. Thus far only a single serum has been tested, and further study on the direct agglutination and agglutinin absorption will be reported later. Sixty-three strains were tested against the single serum, and 19 agglutinated to the full titer of the serum, while the remainder were completely negative. The results of these tests with a single serum indicate that the strains will fall in at least 2 agglutinative groups.

No particular difficulty was experienced in making the tests, as these strains were all diplococci or short-chain streptococci in broth culture, and did not show the slightest tendency toward spontaneous agglutination. The organisms were grown for 24 hours on blood-agar slants, then 3 to 4 c c of sterile 0.2% glucose broth were added aseptically and the cultures were incubated another 24 hours. Heavy suspensions were obtained, which were diluted with formaldehyd-salt solution.

Pathogenicity.—These organisms, which appear to have highly invasive powers in pigs, are not markedly pathogenic for white mice or rabbits. Two mice were inoculated intraperitoneally with 0.5 c c of a saline emulsion of purulent bronchial mucus which yielded many colonies of the inulin-fermenting streptococcus. Neither mouse died. Ten mice were inoculated with suspensions of blood-agar cultures or with serum broth cultures. Three of the 10 mice died. Two of the 3 showed only a B. proteus type of spreader present in the heart blood and peritoneal fluid, with no streptococci demonstrable either by strain or culture (the third mouse was killed by the others). Two others of the 10 inoculated were markedly affected, but recovered, while the other 5 showed no visible reaction.

A rabbit was given 1 c c of a heavy suspension of a blood-agar culture intravenously. No perceptible reaction was noted, and the animal was repeatedly injected with live cultures for the production of the antiserum used in the agglutination tests.

SUMMARY

This paper reports the bacteriologic study of 100 apparently normal lungs of pigs and 314 lungs which showed pneumonic lesions of varying extent and intensity.

Three organisms of possible significance were isolated from the normal lungs: B. suisepticus was found in 4% of the 100 specimens; in 2% it was present in pure culture and in large enough numbers to suggest the possibility of an impending pneumonia; in the other 2% there were only a few colonies of this organism together with a mixture of other bacteria. A nonfermenting, typhoid-like, bacillus, considered a B. alkaligenes type, was found in pure culture in 1 case, and in mixed culture in 2 other cases. An inulin-fermenting streptococcus was isolated from 12% of the cases; in 5 cases there were many colonies present, while in the other 7 cases there were a few colonies together with other organisms; no pure cultures were observed.

A variety of other organisms, particularly streptococci, were observed in small numbers, and always in mixed culture.

B. suisepticus was found in pure culture in 138 cases, or 44% of pneumonic lungs examined. It was found in small numbers mixed with other organisms in 30 more cases, or 10%, making a total of 168 specimens, or 54% of those examined, from which the organism was isolated.

The inulin-fermenting streptococcus was found in pure culture in 91 cases, or 29%. In an additional 6% of specimens it was present in mixed culture in small numbers, making a total of 111 specimens, or 35% of those examined, from which the organism was isolated.

No other organisms appeared in pure culture, nor in mixed culture in sufficient numbers to indicate any etiologic significance.

The 2 strains, B. suisepticus and the inulin-fermenting streptococcus, were found in pure culture, or together in approximately equal numbers, in 63% of the 314 specimens examined. A study of the imbedded tissues is being made and will be reported later.

It appears to be generally accepted that the mere presence of B. suisepticus constitutes sufficient evidence as to its etiologic significance in swine pneumonias. Judged by the same criterion, the streptococcus here described would seem to be of almost equal importance.

Agglutination tests with a single serum indicate that there are at least 2 types within the group of 128 strains of the streptococcus studied. Further work is in progress and will be reported later.